

ELECTROMAGNETIC RELAY POLARIZED BY A PERMANENT MAGNET

The invention relates to a polarized electromagnetic relay with magnetic latching, comprising a fixed magnetic circuit formed by assembly of a first and a second yokes bounding an internal space enclosing :

- a permanent magnet bearing against the bottom part of the first yoke, and designed to create a first magnetic polarizing flux,
- a flux distributor in contact with the opposite face of the permanent magnet,
- a moving core mounted with axial sliding in the direction of the longitudinal axis between an attraction position and a tripping position, and having a polar surface cooperating with the flux distributor by means of an axial air-gap,
- a cylindrical coil mounted on an insulating sheath surrounding the core coaxially, and designed to generate a second operating magnetic flux opposing the first polarizing flux,
- a return spring urging the core to the tripping position when the coil is excited,
- and an external trip push-button securedly united to the moving core.

A relay of this kind is described in the document EP-A 187,055. The flux distributor and permanent magnet are annular so as to enable the return spring which bears on the bottom part of the magnetic circuit to pass through. The other end of the spring is housed in a blind orifice of the core. Housing the spring inside a blind orifice of the magnetic circuit increases the lengthwise dimension of the relay and the weight of the moving core. The hole in the

flux distributor does not provide correct insulation of the magnetic latching zone with respect to the permanent magnet. The tubular yoke is achieved by a costly turning operation.

The object of the invention consists in increasing the speed and reliability of a high-sensitivity polarized relay, and in reducing its lengthwise dimension and manufacturing cost.

The relay according to the invention is characterized in that the return spring passes completely through the core, being inserted between the flux distributor and the external end of a guide tube, which passes axially through an aperture of the second yoke, being securedly united to the core.

The hole opening out from the core, and the axial length less than half of the overall length of the relay enable the weight of the core to be reduced, which enhances the speed of the relay on tripping.

The permanent magnet and flux distributor have appreciably identical external diameters, corresponding to the internal diameter of the insulating sheath.

The shunt flux is then reduced to the minimum, which enables a permanent magnet of reduced size and cost to be used.

The guide tube is shaped as a bottle-neck having a widened part housing the core, and a narrow part capable of sliding in the aperture.

The sheath is provided with a connecting base passing through an orifice in the bottom part of the first yoke for the connecting conductors of the coil to pass through.

The first yoke and/or the guide tube of the core are achieved by a deep drawing operation.

Other advantages and features will become more clearly apparent from the following description of an illustrative embodiment of the invention, given as an example only and represented in cross-section in the accompanying drawing, the left and right half-views of which show the relay respectively in the tripping position, and in the attraction position of the moving core.

In the figure, a high-sensitivity electromagnetic relay 10 acts as tripping device for a mechanism of an electrical circuit breaker. The relay 10 comprises a fixed magnetic circuit 12, and a moving core 14 mounted with axial sliding in the direction of the longitudinal axis XX' between an attraction position (right-hand half-view) and a tripping position (left-hand half-view).

The magnetic circuit 12 is made of ferromagnetic material, and comprises a first tubular yoke 16 closed at one of its ends by a bottom part 18 extending perpendicularly to the longitudinal axis XX'. The yoke 16 and bottom part 18 constitute a single part obtained by a deep drawing operation. Opposite the bottom part 18, a second yoke 20 covers the open end of the first yoke 16 to close the magnetic circuit 12. Assembly of the two yokes 16, 20 is performed either by direct crimping or by means of an additional cover 22 covering the first yoke 16, and having a front edge 24 capable of being folded on an annular shoulder 26 of the second yoke 20. The cover 22 is made of magnetic or non-magnetic material, and has a thickness less than that of the first yoke 16.

The magnetic circuit 12 is polarized by an axial magnetization magnet 28 bearing on the bottom part 18 inside the first yoke 16. A flux distributor 30 is superposed on the magnet 28, and cooperates directly with the polar surface 32 of the moving core 14 via an axial air-gap 33. The magnet 28 and flux distributor 30 have cylindrical shapes of appreciably the same diameter.

The second yoke 20 is equipped with a tubular internal sleeve 34 made of ferromagnetic material extending partially in an annular space arranged coaxially between the moving core 14 and an insulating sheath 36 acting as support for a cylindrical operating coil 38. The opposite front faces of the cylindrical sheath 36 are arranged between the bottom 18 and the second yoke 20 and one of them comprises a connecting base 40 passing through an orifice 42 of the bottom part 18 for the connecting conductors of the coil 38 to pass through.

The coil 38 is mounted coaxially on the insulating sheath 36, whose internal side wall comprises an annular protuberance 44 disposed axially between the free end of the sleeve 34 and the base 40. The role of the protuberance 44 consists in wedging the flux distributor 30 against the magnet 28. The centre part of the flux distributor 30 is provided with a centering pin 46, on which there is wound a return spring 48 urging the moving core 14 to the tripping position when the coil 38 is excited.

The core 14 is fixed inside the widened part of a guide tube 50 in the shape of a bottle-neck, the end of the narrow part of which passes axially through a circular aperture 52 arranged in a bearing 54 of the second yoke 20. The spring 48 passes completely through the core 14 and bears on the flux distributor 30 and the end of the guide tube 50.

The guide tube 50 is advantageously made by a deep drawing operation of a non-magnetic or insulating material having a low friction coefficient. Fixing of the core 14 in the tube 50 is achieved by sticking or by crimping. The end of the tube 50 is covered by a cap 56 arranged as an external trip push-button.

The axial length of the moving core 14 is less than half of the overall length of the relay 10 corresponding to the

distance between the external faces of the bottom part 18 and of the second yoke 20. The weight of the moving assembly is thus reduced to the minimum thereby enabling the speed of the relay 10 to be increased.

Operation of the polarized relay 10 is similar to that described in the document EP-A-187,055. Given that the flux distributor 30 and the permanent magnet 28 have appreciably identical external diameters, corresponding, clearance apart, to the internal diameter of the sheath 36, the shunt flux ϕ_s which loops back directly between the permanent magnet 28 and the first yoke 16 is very low. This results in a minimum size of the permanent magnet 28 formed notably by a single washer made of a material with a rare earths base and a very high coercivity. Operation of the relay 10 is achieved by means of two preponderant opposing fluxes, comprising the first magnetic flux ϕ_u for polarization of the permanent magnet 28, and the second magnetic flux ϕ_c for control of the coil 38.

On the right-hand half-view, the coil 38 is not excited and the core 14 is held in the attraction position against the flux distributor 30 by the action of the first polarizing flux ϕ_u .

The second opposing control flux ϕ_c only occurs when the coil 38 is excited by the tripping signal. As soon as the return force of the spring 48 becomes greater than the magnetic attraction force, the core 14 and guide tube 50 are propelled to the tripping position (left-hand half-view).

It can be noted the spring 48 simply bears on the upper face of the flux distributor 30. Such an arrangement enables the permanent magnet 28 to be insulated from the magnetic latching zone with the core 14.



CLAIMS

1. A polarized electromagnetic relay with magnetic latching, comprising a fixed magnetic circuit (12) formed by assembly of a first and a second yokes (16, 20) bounding an internal space enclosing :

- a permanent magnet (28) bearing against the bottom part (18) of the yoke (16), and designed to create a first magnetic polarizing flux O_u ,

- a flux distributor (30) in contact with the opposite face of the permanent magnet (28),

- a moving core (14) mounted with axial sliding in the direction of the longitudinal axis XX' between an attraction position and a tripping position, and having a polar surface (32) cooperating with the flux distributor (30) by means of an axial air-gap (33),

- a cylindrical coil (38) mounted on an insulating sheath (36) surrounding the core (14) coaxially, and designed to generate a second control magnetic flux O_c opposing the first polarizing flux O_u ,

- a return spring (48) urging the core (14) to the tripping position when the coil (38) is excited,

- and an external trip push-button (56) securedly united to the moving core (14), characterized in that the return spring (48) passes completely through the core (14) being inserted between the flux distributor (30) and the external end of a guide tube (50), which passes axially through an aperture (52) of the second yoke (20), being securedly united to the core (14).

2. The relay according to claim 1, characterized in that the permanent magnet (28) and flux distributor (30) have



appreciably identical external diameters, corresponding to the internal diameter of the insulating sheath (36).

3. The relay according to claim 2, characterized in that the internal wall of the sheath (36) comprises an annular protuberance (44) designed to hold the flux distributor (30) against the permanent magnet (28).

4. The relay according to claim 1, 2 or 3, characterized in that the guide tube (50) is shaped as a bottle-neck having a widened part housing the core (14) and a narrow part capable of sliding in the aperture (52).

5. The relay according to one of the claims 1 to 4, characterized in that the sheath (36) is provided with a connecting base (40) passing through an orifice (42) in the bottom part (18) of the first yoke (16) for the connecting conductors of the coil (38) to pass through.

6. The relay according to one of the claims 1 to 5, characterized in that the first yoke (16) and/or the guide tube (50) of the core (14) are achieved by a deep drawing operation.

7. The relay according to one of the claims 1 to 6, characterized in that the axial length of the moving core (14) is less than half of the overall length of the relay (10), and that the external diameter of the core (14) is greater than the diameter of the aperture (52).

8. The relay according to one of the claims 3 to 7, characterized in that the second yoke (20) comprises a tubular internal sleeve (34) arranged radially between the sheath (36) and the guide tube (50), and extending axially up to the vicinity of the protuberance (44).

9. The relay according to one of the claims 1 to 8, characterized in that assembly of the first and second yokes



(16, 20) is achieved by crimping by means of an additional metal cover (22) covering the first yoke (16), and having a front edge (24) capable of being folded on an annular shoulder (26) of the second yoke (20).